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MAN, H.S.		
TZKE, J.C.		
LINGAME, A.H.		
P, R.D.		
UCHER, D.W.		
S, J.G.		
RED, J.E.	X	
RERA, D.W.		
NCIS, G.E.	X	
OWIN, R.		
NI, B.J.		
MAN, L.K.		
LY, T.J.		
KER, E.H.		
S, J.P.		
SH, J.M.	X	
BY, W.A.		
STER, A.W.		
EG, D.		
E.M.	X	
JESTIC, J.R.		
RX, G.E.		
URRENS, B.E.		
RGAN, R.V.	X	
TER, G.L.	X	
UTO, V.M.		
EFU, B.F.		
IN, N.B.		
PLER, L.R.		
ANSON, E.R.		
BE, J.S.		
KINSON, R.B.	X	
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RF-46469 (Rev. 10/91)

EG&G ROCKY FLATS, INC.
ROCKY FLATS PLANT, P.O. BOX 464, GOLDEN, COLORADO 80402-0464 • (303) 966-7000

February 11, 1992

92-RF-1057

Robert M. Nelson, Jr.
Manager
DOE, RFO

Attn: F. R. Lockhart

TRANSMITTAL OF BENCH SCALE TREATABILITY STUDY PROGRESS REPORT - JEE-0085-92

Enclosed are three copies of a progress report on the Bench Scale Treatability Study of Filter Flow Technology (formerly Techtran) for transmittal to the Environmental Protection Agency (EPA) and Colorado Department of Health (CDH). This project is being performed in collaboration with EPA under their Superfund Innovative Technologies Evaluation (SITE) Program. A draft letter of transmittal listing addressees is enclosed.

If you have any questions or require further information, please contact J.C. Laul of the Technology Development Department at extension 3254 or T.C. Greengard of Environmental Research and Technology at 273-6073.

J. E. Evered, Director
Environmental Management

JCL:cet

Orig. and 1 cc - R. M. Nelson, Jr.

Enclosure:
As Stated

cc:
S. R. Grace - DOE, RFO
I. B. Lehr - "

ADMIN RECORD

SW-A-003651

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EG&G ROCKY FLATS

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INTEROFFICE CORRESPONDENCE

DATE: February 5, 1992

TO: Distribution

FROM: J. C. Laul, Technical Investigations, Bldg. T881B, X3254

SUBJECT: BENCH SCALE TREATABILITY STUDY FILTER FLOW TECHNOLOGY - JCL-010-92

This memorandum is a followup to the December 20, 1991 meeting among EG&G, DOE, EPA, CDH, and PRC. Its purpose was to make a decision whether to continue the Filter Flow (formerly Techtran) project. A tentative "go" decision, based on U-238 only, was made subject to confirmation with the additional analyses of U-238, Pu-239 and Am-241 radionuclides by the EG&G Rocky Flats laboratory. These results are in and the data, experiments and evaluations are summarized in the attached progress report.

The radionuclide results look promising for approving a demonstration unit on site. However, we plan to repeat one to three experimental conditions in order to select the final test conditions that will maximize the retention factors for U-238, Pu-239 and Am-241 radionuclides.

If you have any questions or require further information, please contact J.C. Laul of the Technology Department at extension 3254 or T.C. Greengard of Environmental Research and Technology at 273-6073.

JCL/cet

Attachment:
As stated

Distribution

M. B. Arndt
C. E. Baldwin
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Bench Scale Treatability Study Of Techtran (Now Filter Flow) Technology

PROGRESS REPORT

Bench scale treatability study of Filter Flow Technology was carried out in the week of September 30, 1991 with RFP groundwater ITPH# 95, using radioactive tracers; Pu-239 26.4 pc/l, Am-241 22.2 pc/l, and Ra-226 23.0 pc/l under eight experimental conditions. The ITPH 95 waste water is mostly bicarbonate (pH 7.6) and contains about 32 pc/l of U-238 and 52 pc/l of U-234. The purpose of these experiments was to evaluate the feasibility of Filter Flow Technology for a "go or no go" decision and also establish an optimum condition for maximum retention of radionuclides such as U-238, Pu-239 and Am-241.

The details of eight experimental conditions tested were outlined in J.C. Laul's October 17, 1991 memo. In brief, they were: 1) as such at pH 7.6 (base line); 2) pH 8.0 + sodium sulfide; 3) pH 9.0 + sodium bisulfite + sodium sulfide; 4) pH 9.0 + sodium sulfide; 5) pH 8.0 + sodium bisulfite + sodium sulfide; 6) pH 9.0 + sodium bisulfite + sodium sulfide (slow vs fast flow rate); 7) effect of minerals overnight and then at pH 9.0 + sodium bisulfite + sodium sulfide; 8) overnight equilibration of the Filter Flow plus material + sodium sulfide. The purpose of sodium bisulfite (reducing agent) was to reduce U+6 to U+4 state and Pu+4 to Pu+3 state. The pH of effluent in each experiment was 12.2 to 12.7. The flow rate in each experiment was about 150-200 ml/min. Each experiment was run with 5 gallons of ITPH 95 waste water. A schematic diagram of the experimental set up is shown in Fig. 1.

The influent or intermediate and effluent (total 17 samples) were analyzed for various major and trace elements and gross alpha and beta, with special emphasis on U-238, Pu-239 and Am-241 radionuclides. These results are shown in Tables 1 and 2. Based on the gross alpha and radionuclide results, all eight experimental conditions appear favorable for a "go" decision for the future demo. The retention factors for U-238, Pu-239 and Am-241 range from 200 to 1000. Since the effluent values for these radionuclides (Table 1) are at the detection limits <.05 pc/l (negative values also mean detection limits), the true retention factors may be still higher. It is rather difficult to establish which condition is more favorable than the other. Therefore, EG&G in collaboration with Tod Johnson (Filter Flow Technology) will repeat 1 to 3 conditions (total 6 samples), among the first five experimental conditions, to ensure reproducibility and reliability and to decide the final condition that will be used for the on site demo in 1992.

Among the major cations and trace elements, there appears to be no sorption for Calcium, Barium, Potassium, Sodium, and Strontium, indicating that the alkali (Na, K) and alkaline earths (Ca, Ba, Sr) are not retained by the Filter Flow Plus bed. On the other hand, there is some to significant sorption of elements such as Aluminum, Copper, Iron, Magnesium, Manganese, and Zinc. This is probably due to precipitation and co-precipitation of hydroxide and sulfide. The Filter Flow concept is a combination of ion-exchange, colloids, and co-precipitation processes. In comparison with the fast vs slow flow rate (Exp-6), the slow flow rate (long residence time) seems to yield better retention factors for trace metals and radionuclides.

Summary: The radionuclide results look promising for a "go" decision for a demonstration unit on site. However, we plan to repeat 1 to 3 experimental conditions in order to select the final test conditions that will maximize the retention factors for U-238, Pu-239 and Am-241 radionuclides.

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Table 1. BENCH SCALE STUDY RESULTS*
(PC/L)

Experiment		U-238	U-234	Pu-239	Am-241	Gross Alpha	Gross Beta
Run-1 as such	INF	35.0± 6.5	56.0± 10	6.8 ± 1.2	22.0± 3.8	166± 15	124± 8
	EFF	-.01± .03	-.03± .03	-.01± .02	-.01± .01	23± 6	57± 7
Run-2 pH8 + S.S	INT	31.0± 5.4	49.0± 8.2	3.8 ± .76	1.2 ± .41	46± 5	34± 5
	EFF	-.01± .03	.02± .04	-.02± .02	.043± .03	17± 5	54± 9
Run-3 pH9 + R.A + S.S	INT	32.0± 6.0	50.0± 9.0	8.1 ± 1.4	4.3 ± .85	133± 13	99± 12
	EFF	.03± .05	.04± .06	-.02± .01	.01 ± .02	18± 6	63± 8
Run-4 pH9 + S.S	INT	31.0± 4.5	51.0± 7.1	4.9 ± .84	3.4 ± 1.1	89± 11	62± 8
	EFF	.01 ± .03	-.02± .03	-.03± .01	-.01± .02	21± 5	55± 9
Run-5 pH8 + R.A + S.S	EFF	-.01± .03	-.01± .04	-.02± .02	-.01± .01	34± 4	73± 8
Run-6 pH9 + R.A + S.S	INF	12.0± 2.2	18.0± 3.3	22.0± 3.5	26.0± 3.8	82± 8	44± 8
	INT	7.5± 1.2	12.0± 2.0	9.0 ± 1.3	6.0 ± 1.2	42± 4	20± 7
Fast Flow	EFF-1	.01± .03	.01± .03	-.01± .02	.015± .02	24± 5	31± 6
Slow Flow	EFF-2	.02± .03	.01± .03	-.01± .02	.03 ± .03	13± 4	24± 7
Run-7 Minerals pH9 + R.A + S.S	INT	11.0± 2.1	17.0± 3.1	14.0± 2.3	(17 ± 5.8)	85± 9	42± 6
	EFF	-.01± .03	-.01± .04	.01 ± .02	.059± .052	19± 5	34± 7
Run-8 Overnight Equil. + S.S	INT	3.3± .82	5.1± 1.1	6.1 ± 1.0	9.2 ± 2.4	46± 8	35± 8
	EFF	-.01± .03	-.01± .03	-.01± .02	.05 ± .04	14± 3	31± 5

* Tracers used: U-232 (4.7pc), Pu-242 (4.0pc), Cm-244 (4.5pc).
200 ml was taken for INF and INT; 1 litre for EFF. Values in () shows poor yield.
S.S= Sodium Sulfide; R.A= Reducing agent - Sodium bisulfite

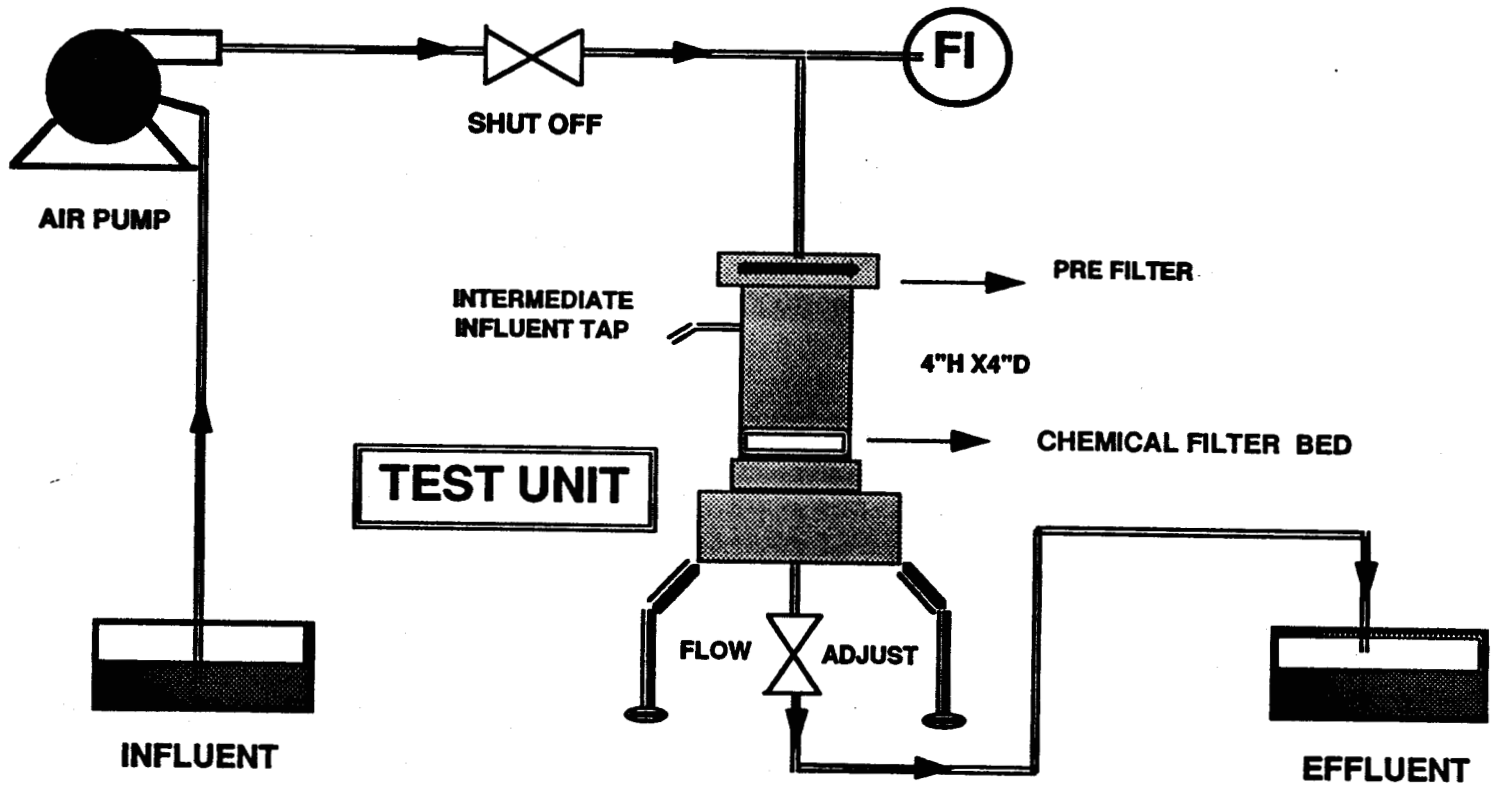
Table 2 BENCH SCALE STUDY RESULTS (UG/L)*

	Run-1 as such		Run-2 pH8+S.S		Run-3 pH9+R.A+S.S		Run-4 pH9+S.S		Run-5 pH8+RA+SS	Run-6 pH9+R.A+S.S				Run-7 pH9+R.A+S.S		Run-8 Overnight+S.S	
Elem.	INF	EFF	INT	EFF	INT	EFF	INT	EFF	EFF	INF	INT	EFF-1 Fast	EFF-2 Slow	INT	EFF	INT	EFF
Al	1310	126	136	368	144	113	130	130	130	1450	314	258	96	1560	117	25500	209
Sb	45	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
As	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70	<70
Ba	162	103	52	90	154	92	78	84	98	76	48	58	69	70	69	71	70
Be	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cd	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Ca(mg)	270	161	90.4	138	272	177	132	141	156	91.3	59.4	72.6	87.2	83.6	93.8	101	99.7
Cr	15	13	8.1	<5	7.1	<5	<5	<5	<5	7.6	5.4	7.0	<5	6.6	<5	6.9	<5
Co	7.7	<3	<3	<3	4.8	<3	<3	<3	<3	3.0	<3	4.8	<3	5.5	<3	<3	3.1
Cu	244	332	<11	<11	<11	<11	<11	<11	<11	13	<11	<11	<11	17	<11.	<11	<11
Fe	1360	360	105	<23	51	<23	157	<23	<23	1200	261	55	<23	6290	33	6840	<23
Pb	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45
Mg(mg)	69.6	.193	29.4	1.27	69.9	.090	42.7	.375	.221	20.4	13.0	.58	.113	17.7	.173	101	.371
Mn	27.1	5.3	3.4	1.1	14.0	<1	5.6	<1	<1	26	14	5.1	<1	120	3.6	80	<1
Mo	7.0	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Ni	26	22	40	<14	<14	<14	16	14	<14	14	<14	<14	<14	<14	<14	<14	<14
K(mg)	55.6	55.2	23.3	54.4	56.0	56.3	33.9	56.2	55.4	23.5	14.3	19.7	23.4	19.4	21.9	21.2	23.0
Se	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Ag	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Na(mg)	359	364	188	440	635	639	278	461	571	199	196	273	325	240	281	205	229
Sr(mg)	2.21	1.78	.86	1.71	2.23	1.81	1.24	1.73	1.74	.65	.42	.56	.64	.58	.65	.62	.64
Zn	103	82	68	15	43	8.0	76	8.8	9.9	72	304	7.3	4.3	129	6.0	39.0	3.7
Si(mg)	6.7	<1.0	6.9	<1.0	6.9	<1.0	6.5	<1.0	<1.0	-	-	-	-	-	-	-	-

* The data are by ICP (ug/l) unless specified. Si value is from Radian(PRC). V= <10 ug/l and Tl= <300 ug/l in INF-INT-EFF.
S.S= Sodium Sulfide; R.A= Reducing agent - Sodium bisulfite.

ENVIRONMENTAL MEASUREMENTS, INSTRUMENTATION, DATA ACQUISITION

WATER TREATABILITY STUDIES



10/17/91

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FIGURE I